2.4.12. Introduction to Advanced Air-to-Ground Radar Test Techniques

As mentioned in Chapter 1, only the most rudimentary form of the air-to-ground radar test techniques are presented in this book. Chapter 1 details the reasons for this format; however, in many applications, more rigor, accuracy and documentation of results are required. Table II outlines additional instrumentation and assets which are typically applied in these more advanced tests. The purpose of this table is merely to emphasize the existence of these advanced techniques. Further, this list is not exhaustive. Many innovative uses of assets and instrumentation exist. It is hoped that the examples provided leave the reader with a taste of how the test can be made more rigorous through the judicious use of instrumentation. In application; the user must refer to the more advanced documents referenced in Chapter 1 or solicit help from more experienced testers.

Table II: Additional Assets or Instrumentation for use in Advanced Air-to-Ground Radar Tests

Test	Additional Asset or Instrumentation	Purpose/Benefit
Scan Rate.	Digital recording of radar data.	In some systems the sweep position can be digitally recorded as output of a scan converter. In this case the instantaneous as well as the average scan rate can be calculated as required.
	Time stamped video recording of display.	Even in the absence of digital data, the instantaneous and average scan rates can be derived using appropriately time stamped video.
Scan Angle Limits.	Digital Recording of time stamped aircraft heading and position, time stamped video recording of display and a geographically surveyed ground target.	The test can be made more accurate by recording the precise time, the precise test aircraft location and heading (these parameters are either derived and recorded on-board or using a space positioning range as appropriate), and using a target with a precisely surveyed location. The radar display is video recorded and time stamped and as the target disappears, the exact angle off boresight can be derived based upon geometric calculations.
Elevation Angle Limits.	Similar to scan angle limits except vertical angles are recorded vice headings.	Similar to scan angle limits except the vertical angles to the target are calculated vice the horizontal angles.
Antenna Stabilization Limits.	Digital recording of test aircraft time stamped roll, pitch and yaw rates and time stamped video recording of the display.	The direct measurement of the roll, pitch and yaw rates are correlated to degradation on the time stamped display.

Table II: Additional Assets or Instrumentation for use in Advanced Air-to-Ground Radar Tests (Continued)

Test	Additional Asset or Instrumentation	Purpose/Benefit
Minimum Range.	Time stamped video recording of display, digital recording of time stamped digital radar data, time stamped recording of test aircraft location and surveyed radar target.	The loss of detection on the display is time correlated with the recorded aircraft and known target positions to derive the minimum detection range. Range space positioning data or onboard instrumentation may be used to derive the test aircraft position. Recorded radar data can be correlated with the display output to isolate any problems as either radar or display related.
Doppler Beam Sharpened Notch Width.	Video recording of radar display.	The video recording can be used to make more accurate and liesurely ground measurements.
Range and Bearing Accuracy.	Digital recording of time stamped test aircraft position and time stamped radar display video or digital radar data with radar derived bearing and range to a surveyed target.	Test aircraft location from either onboard instrumentation or range space positioning data are used to calculate the actual range and bearing to a surveyed target at the time a range and bearing is derived using the radar. The video recorded range and bearing or the range and bearing from the digitally recorded cursor position are compared directly.
Range and Bearing Resolution.	Digital recording of time stamped test aircraft location. Time stamped video recording of the radar display. Surveyed resolution array.	The resolutions can be directly determined by geometrically comparing the positions of the surveyed targets and the test airplane at the time breakout occurs. Range space positioning data or onboard instrumentation may be used to derive the test aircraft position.
Maximum Detection Range.	Video recording of time stamped radar display. Time stamped test aircraft location. Propagation prediction assets. Real time measurement of casual interference. Surveyed target locations.	The test aircraft and surveyed target locations are geometrically reduced to provide actual, time stamped locations of the targets in radar space. This information is used to validate hits and misses at corresponding bearings and ranges on the targets as recorded on the radar display. Often, the real time propagation performance is predicted on instrumented ranges for the frequency of the test radar and casual interference is recorded on the aircraft using special instrumentation. Sometimes this information is already designed into the test radar and needs only to be recorded.
Mapping Quality and Consistency.	Video recording of the radar display.	Video recording allows repeated vewing while on the ground.

Table II: Additional Assets or Instrumentation for use in Advanced Air-to-Ground Radar Tests (Continued)

Test	Additional Asset or Instrumentation	Purpose/Benefit
Mission Utility and Integration.	Digital recording of precise, time stamped test aircraft position, rates and accelerations; surveyed targets; digital recording of time stamped radar data; time stamped video recording of radar and head up display.	This test requires the largest amount of data to completely document the results. It is during this test that most of the unexpected problems are found. In anticipation of having to document these deficiencies, maximum instrumentation and range support are sometimes brought to bear in case unforseen data are required in post-flight analysis.